Washington Department of FISH and WILDLIFE

Deschutes Estuary Feasibility Study Phase III: Engineering Design and Cost Estimates

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Agenda

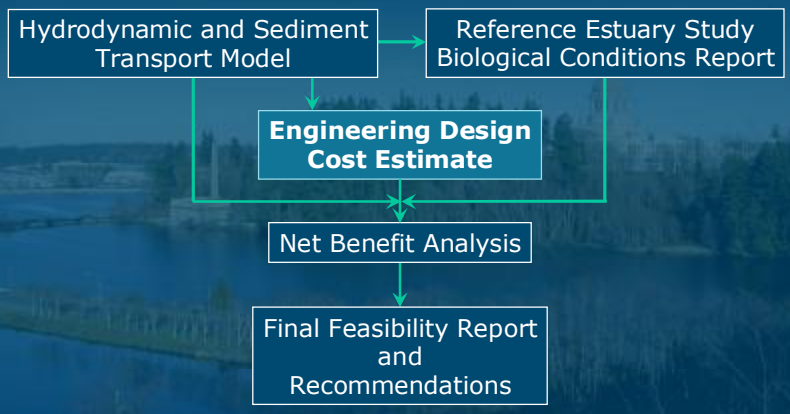
- Setting the Scene
- Estuary Restoration – Estuarine Hydrodynamics
- Estuary Restoration – Engineering Design
- Cost Estimating Approach
- Cost Estimates and Schedule
- Conclusions
- Questions & Answers

Setting the Scene

- Capitol Lake has increasing problems
- Sediment is filling the Lake
- Dredging is increasingly expensive
- Noxious weeds are invading
- The Capitol Lake Dam restricts salmon runs

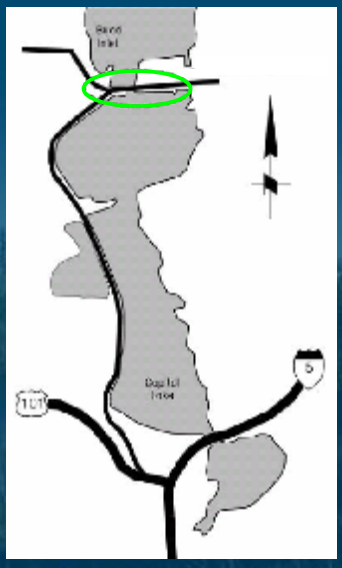
Setting the Scene

- 2002 Capitol Lake Adaptive Management Plan called for a **Deschutes Estuary Feasibility Study**



Setting the Scene

- **Alternative A**
  - New 5th Avenue Bridge

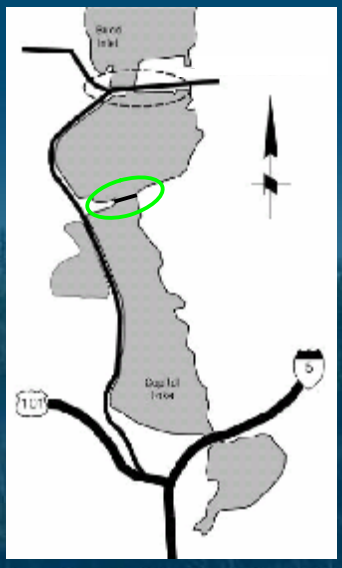


Setting the Scene

- **Alternative A: New 5th Avenue Bridge (All Alternatives)**

Setting the Scene

- **Alternative A**
  - New 5th Avenue Bridge
- **Alternative B**
  - Add New Railroad Bridge

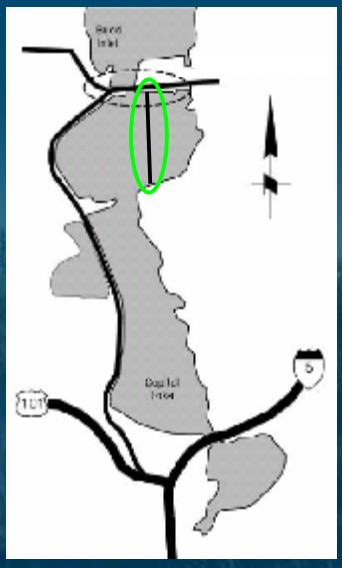


Setting the Scene

- **Alternative B: Add New Railroad Bridge**

Setting the Scene

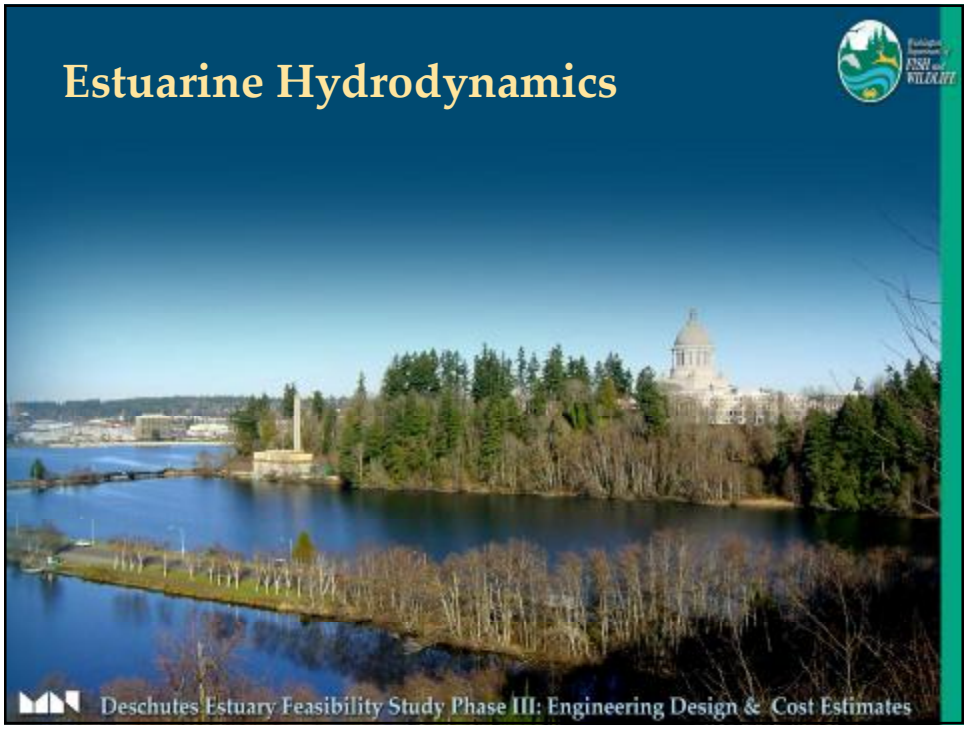
- Alternative A
  - New 5th Avenue Bridge
- Alternative B
  - Add New Railroad Bridge
- Alternative D
  - Add Reflecting Pool Barrier



Setting the Scene

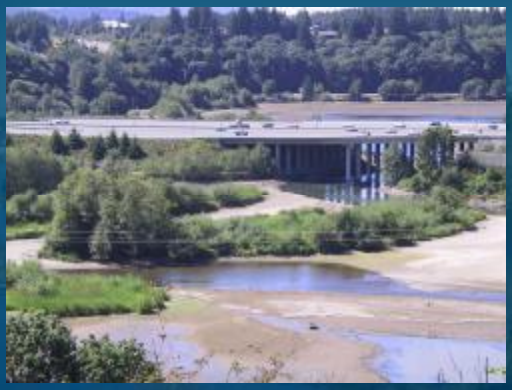
- Alternative D: Add Reflecting Pool Barrier

Estuarine Hydrodynamics

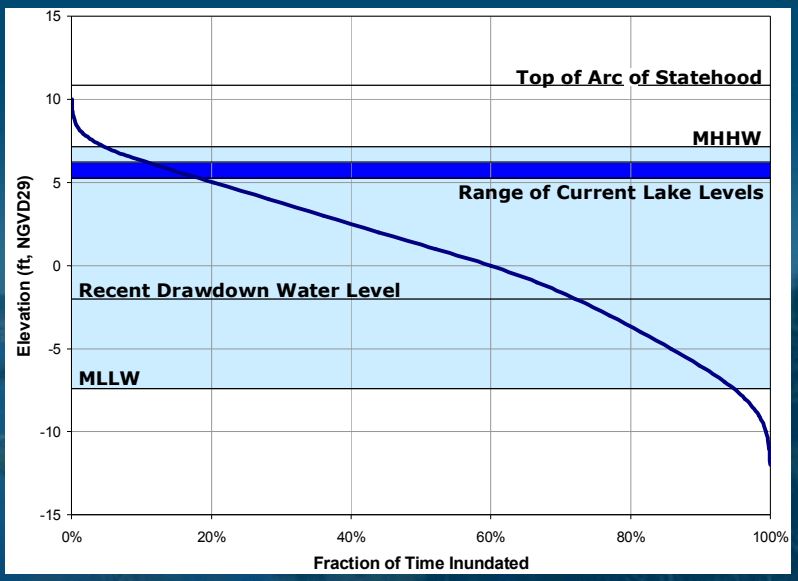


Estuarine Hydrodynamics

- Low Tide – Aesthetic questions
- Drawdown to -2 feet NGVD29

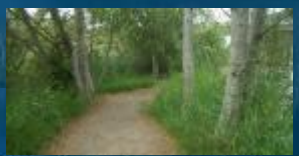


Estuarine Hydrodynamics



Estuarine Hydrodynamics

- High Tide – Flood Risks
- 100-year flood elevation similar to present:
  - Heritage Park Bulkhead
  - Parking lot at GA Powerhouse
  - Tumwater Historical Park trails
- Improvements to present situation:
  - Slightly lower (4″-6″) peak flood compared to present
  - Management not dependent on dam gates



Estuarine Hydrodynamics

- Rapid water level drawdown can destabilize slopes
- Rapid flow through bridges can cause scour
- Sediment will be eroded from channels, deposited in Budd Inlet (Port and Marina)
- Salinity changes will cause vegetation die-off
- All of these effects can be designed for

Engineering Design

Engineering Design

- New 5th Avenue Bridge – All Alternatives

Engineering Design

- New 5th Avenue Bridge

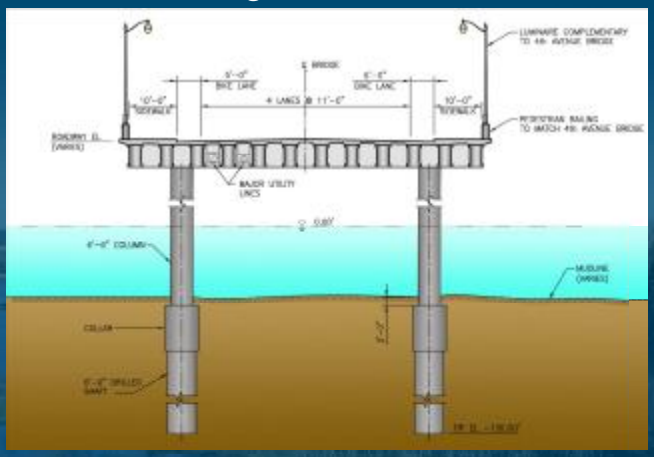
Engineering Design

- New 5th Avenue Bridge
  - Precast, prestressed concrete girder bridge on drilled shafts
  - Maintain utility connections across lake

  - Railings, fittings, etc, consistent with 4th Ave Bridge
  - Extend westmost pier of 4th Ave Bridge to allow for later scour

Engineering Design

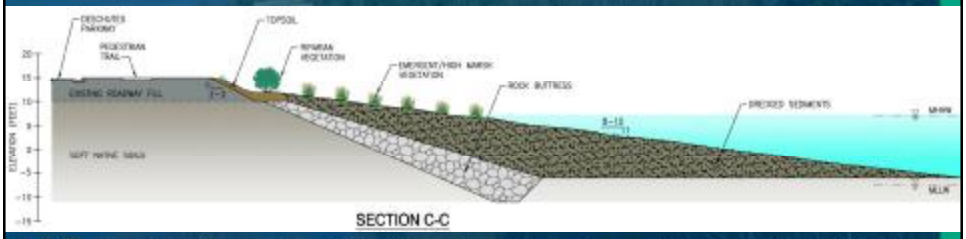
- New 5th Avenue Bridge



- Construction Cost: $20M to $24M

Engineering Design

- **Deschutes Parkway Edge Protection – All Alternatives**
  - Accretional over the long-term – erosion protection is not needed
  - Need to avoid deep slope failures due to tidal fluctuations
  - Rock buttress is least costly alternative
  - Combine with channel pre-dredging, sediment placement for habitat creation



Engineering Design

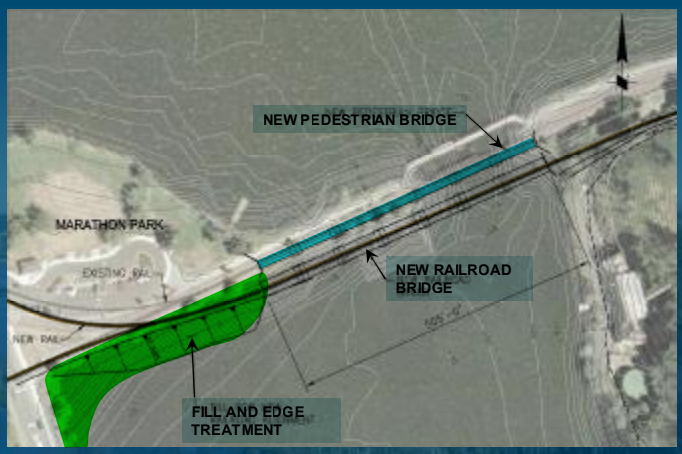
- **Channel Pre-Dredging – All Alternatives**
  - Decreases sediment transport to Budd Inlet
  - Provides sediment for Deschutes Parkway habitat improvements
  - Quantity, cost depend on sediment characteristics
- **Construction Costs:**
  - Deschutes Parkway Edge Protection: $12M to $17M
  - Channel Pre-Dredging: $9M to $23M

Engineering Design

- New Railroad Bridge and Pedestrian Bridge – Alternative B

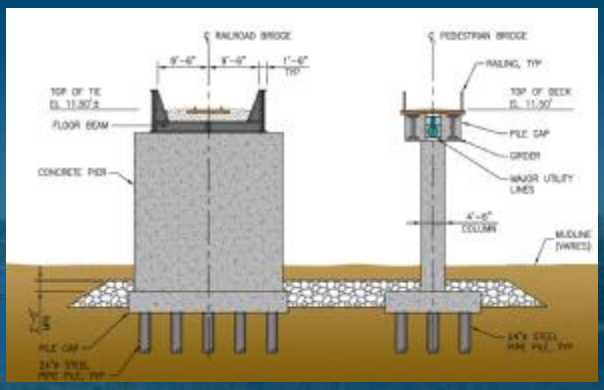
Engineering Design

- New Railroad Bridge and Pedestrian Bridge



Engineering Design

- New Railroad Bridge and Pedestrian Bridge



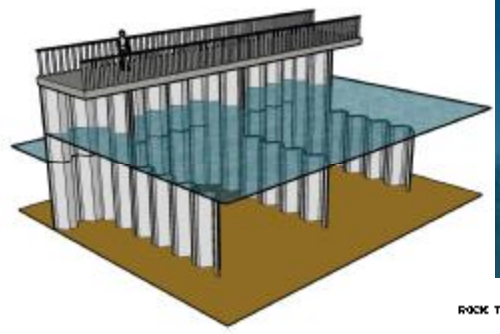
- Construction Cost: $9M to $11M
- Alternatives A & D Scour Protection: < $1M

Engineering Design

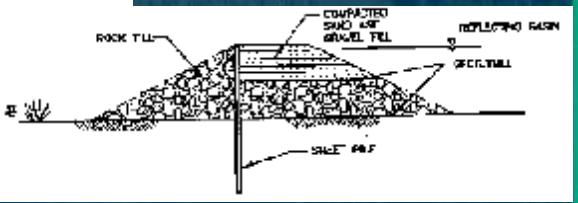
- Reflecting Pool Barrier – Alternative D

Engineering Design

- Reflecting Pool Barrier



- Sheet pile structure proposed
  - Smaller footprint than rubble-mound
  - Fewer geotechnical, construction risks
  - Similar or lower cost

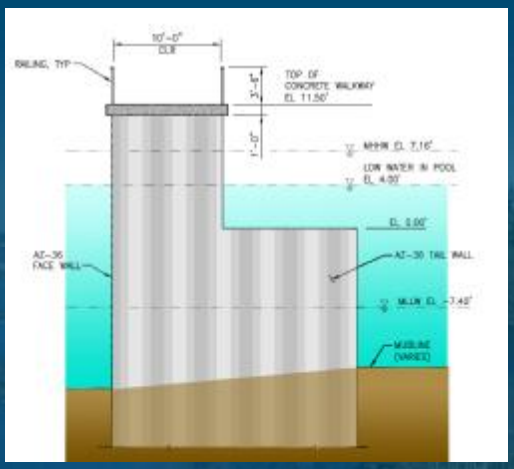


Engineering Design

- Reflecting Pool Barrier
- Freshwater pool requires reclaimed water, pumps, filters…

Engineering Design

- Reflecting Pool Barrier



- Salt-Water Pool
  - Water circulation using tide gates

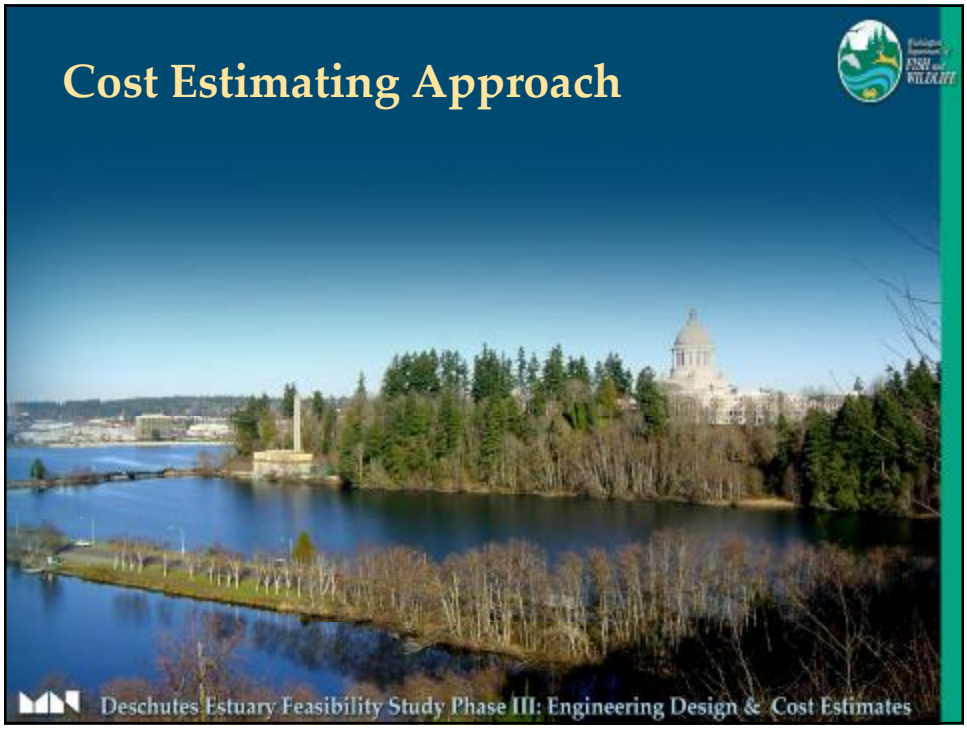
  - Outlet gate 3-feet below MHHW
  - Inlet gate near bottom
  - Residence time for water in the pool is 4 days
- Construction cost: $15M - $23M

Engineering Design

- Minor Improvements – All Alternatives
  - Scour protection at existing bridges
  - Recreational
  - Interpretive

- Construction cost: $2M - $4M

Cost Estimating Approach



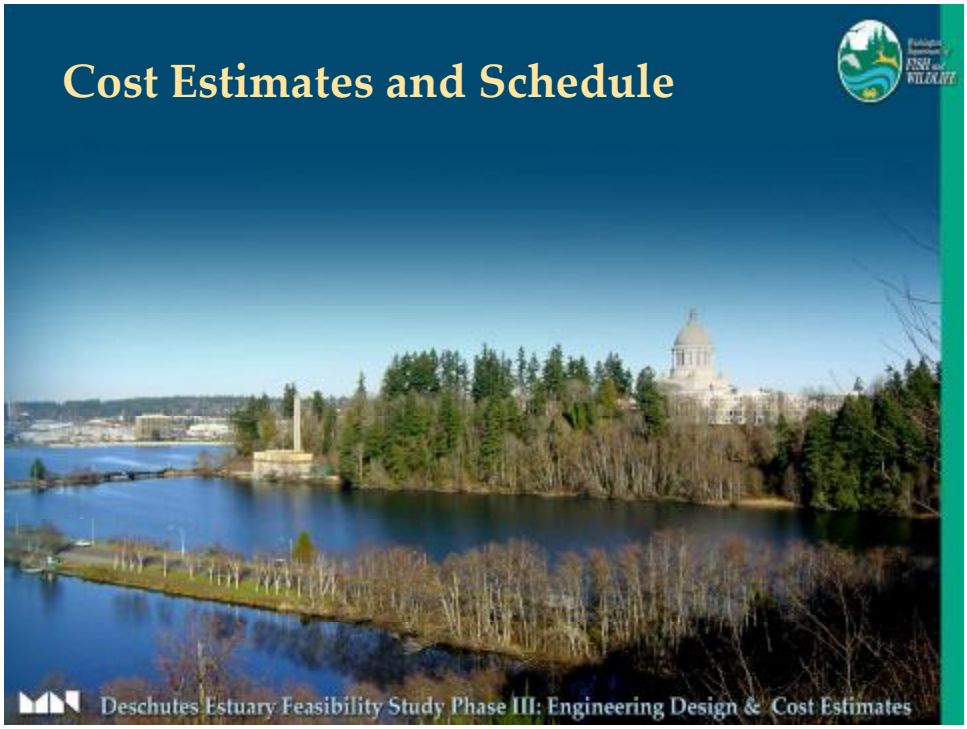
Cost Estimating Approach

- **Range in Cost Estimate**
  - No detailed design
  - Fluctuations in different costs over time
  - General construction inflation
- **Estimate Average, High, and Low Values**
  - Quantity of each item based on present design
  - Cost of each item based on recent projects
  - Construction date and inflation rate
- **Monte Carlo Analysis gives Average, High and Low Values for Overall Cost**

Cost Estimating Approach

- Contingency (30%) Added to Each Item
- Costs in Addition to Construction
  - Engineering
  - Permitting
  - Sales Tax
  - Management
  - Construction Change Orders…
- Inflation
  - Consumer inflation predicted at 2% annually
  - Construction inflation (1990-2005) has been 3.5% annually
  - WSDOT experienced 12% (2001-2005) – unlikely to continue ; 6% annually used as maximum likely

Cost Estimates and Schedule



Cost Estimates

	Low Cost	Average Cost	High Cost
Alternative A			
Construction Cost (2006 dollars)	$46M	$53M	$61M
Total Project Cost (2006 dollars)	$65M	$76M	$87M
Inflated to 2012 Start at 3.5%/year	$83M	$95M	$109M
Alternative B			
Construction Cost (2006 dollars)	$55M	$63M	$72M
Total Project Cost (2006 dollars)	$79M	$90M	$102M
Inflated to 2012 Start at 3.5%/year	$99M	$112M	$128M
Alternative D			
Construction Cost (2006 dollars)	$66M	$75M	$84M
Total Project Cost (2006 dollars)	$94M	$106M	$120M
Inflated to 2012 Start at 3.5%/year	$117M	$133M	$150M

Cost Estimates

- **Main Cost Items (Construction, 2006 Dollars):**
  - 5th Avenue Bridge - $20M to $24M
  - Channel Pre-Dredging - $9M to $20M
  - Deschutes Parkway Edge Treatment - $12M to $17M
  - New Railroad Bridge (Alternative B) - $9M to $11M
  - Reflecting Pool Barrier (Alternative D) - $15M to $23M
- **Main Cost Uncertainties:**
  - Quantity of Channel Pre-Dredging Needed
  - Cost of Steel, Penetration Depth for Reflecting Pool Barrier
- **Inflation**
  - Waiting until 2020 with 6% inflation will double the cost

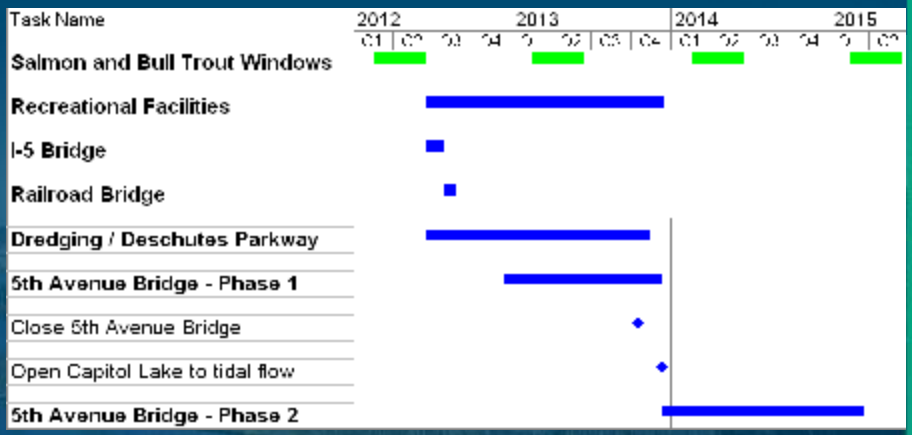
Cost Estimates

- **Maintenance Dredging in Budd Inlet**
  - Initial dredging after 3 years
  - Ongoing dredging every decade
  - Costs shown for A & B – costs for D are higher

	Low Cost	Average Cost	High Cost
3-Year Maintenance Dredging			
Construction Cost (2006 dollars)	$1.7M	$4.9M	$8.4M
Total Project Cost (2006 dollars)	$2.4M	$7.0M	$12.0M
10-Year Ongoing Dredging			
Construction Cost (2006 dollars)	$11M	$20M	$31M
Total Project Cost (2006 dollars)	$15M	$30M	$44M

Schedule

- **Construction Schedule – Alternative A**



- **Other Alternatives Similar**

Conclusions

- **All Restoration Alternatives are Feasible**
  - No fatal flaws
  - Improves habitat and water quality
  - Estuary restoration does not increase flood risk
- **Channel Pre-Dredging and Placement on West Side**
  - Costly with a wide cost range
  - Decreases ongoing maintenance costs, improves habitat
  - Costs can be tightened by measuring sediment qualities (erodibility, potential contamination)

Questions & Answers